

## QMM\_Assignment4

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Q2)

- 1) What is the minimum cost of providing oil to the refineries? Which wells are used to capacity in the optimal schedule?

Supply is 276 TBD and the demand is 274 TBD. So, the demand is not equal to supply.

As given in the problem, the minimum objective function is formulated below:

$$\begin{aligned} Z_{\min} = & 1.52 X_{1A} + 1.60 X_{1B} + 1.40 X_{1C} + 1.70 X_{2A} + 1.63 X_{2B} + 1.55 X_{2C} + 1.45 X_{3A} + 1.57 \\ & X_{3B} + 1.30 X_{3C} + 5.15 X_{A1} + 5.12 X_{B1} + 5.32 X_{C1} + 5.69 X_{A2} + 5.47 X_{B2} + 6.16 X_{C2} + 6.13 \\ & X_{A3} + 6.05 X_{B3} + 6.25 X_{C3} + 5.63 X_{A4} + 6.12 X_{B4} + 6.17 X_{C4} + 5.80 X_{A5} + 5.71 X_{B5} + 5.87 \\ & X_{C5} \end{aligned}$$

Constraints:

$$\text{Supply Constraints } X_{1A} + X_{1B} + X_{1C} = 93 \quad X_{2A} + X_{2B} + X_{2C} = 88 \quad X_{3A} + X_{3B} + X_{3C} = 95$$

$$\begin{aligned} \text{Demand Constraints } X_{A1} + X_{B1} + X_{C1} &= 30 \quad X_{A2} + X_{B2} + X_{C2} = 57 \quad X_{A3} + X_{B3} + X_{C3} = 48 \\ X_{A4} + X_{B4} + X_{C4} &= 91 \quad X_{A5} + X_{B5} + X_{C5} = 48 \end{aligned}$$

Constraints from pumps to refinery

$$\begin{aligned} X_{1A} + X_{2A} + X_{3A} &= X_{A1} + X_{A2} + X_{A3} + X_{A4} + X_{A5} \quad X_{1B} + X_{2B} + X_{3B} = X_{B1} + X_{B2} + X_{B3} + \\ &X_{B4} + X_{B5} \quad X_{1C} + X_{2C} + X_{3C} = X_{C1} + X_{C2} + X_{C3} + X_{C4} + X_{C5} \end{aligned} \quad \text{Where, } X_{ij} \geq 0: i(\text{pumps}) = (A, B, C), j = 1, 2, 3(\text{wells}), 1: 5(\text{refineries})$$

Using Ipsolve the optimal solution is 1932.3

Well 3 has used to the capacity in the optimal schedule.

```
library(lpSolveAPI)
lpprec<-make.lp(0,24)
lp.control(lpprec,sense='min')

## $anti.degen
## [1] "fixedvars" "stalling"
##
## $basis.crash
## [1] "none"
##
## $bb.depthlimit
## [1] -50
##
```

```

## $bb.floorfirst
## [1] "automatic"
##
## $bb.rule
## [1] "pseudononint" "greedy"          "dynamic"          "rcostfixing"
##
## $break.at.first
## [1] FALSE
##
## $break.at.value
## [1] -1e+30
##
## $epsilon
##      epsb      epsd      epsel      epsint  epsperturb  epspivot
##      1e-10      1e-09      1e-12      1e-07      1e-05      2e-07
##
## $improve
## [1] "dualfeas" "thetagap"
##
## $infinite
## [1] 1e+30
##
## $maxpivot
## [1] 250
##
## $mip.gap
## absolute relative
##      1e-11      1e-11
##
## $negrange
## [1] -1e+06
##
## $obj.in.basis
## [1] TRUE
##
## $pivoting
## [1] "devex"      "adaptive"
##
## $presolve
## [1] "none"
##
## $scalelimit
## [1] 5
##
## $scaling
## [1] "geometric"  "equilibrate" "integers"
##
## $sense
## [1] "minimize"
##

```

```

## $simplextype
## [1] "dual"    "primal"
##
## $timeout
## [1] 0
##
## $verbose
## [1] "neutral"

set.objfn(lprec,c(1.52,1.60,1.40,1.70,1.63,1.55,1.45,1.57,1.30,5.15,5.12,5.32
,5.69,5.47,6.16,6.13,6.05,6.25,5.63,6.12,6.17,5.80,5.71,5.87))
add.constraint(lprec,c(1,1,1),"=",93,indices = c(1,2,3))
add.constraint(lprec,c(1,1,1),"=",88,indices = c(4,5,6))
add.constraint(lprec,c(1,1,1),"=",95,indices = c(7,8,9))
add.constraint(lprec,c(1,1,1),"=",30,indices = c(10,11,12))
add.constraint(lprec,c(1,1,1),"=",57,indices = c(13,14,15))
add.constraint(lprec,c(1,1,1),"=",48,indices = c(16,17,18))
add.constraint(lprec,c(1,1,1),"=",91,indices = c(19,20,21))
add.constraint(lprec,c(1,1,1),"=",48,indices = c(22,23,24))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)), "=",0,indices=c(1,4,7,10,13,16,19,22,25))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)), "=",0,indices=c(2,5,8,11,14,17,20,23,26))
add.constraint(lprec,c(rep(1,3),rep(-
1,6)), "=",0,indices=c(3,6,9,12,15,18,21,24,27))
solve(lprec)

## [1] 0

get.objective(lprec)

## [1] 1932.3

get.constraints(lprec)

## [1] 93 88 95 30 57 48 91 48 0 0 0

get.variables(lprec)

## [1] 0 0 93 0 0 88 0 0 95 0 30 0 0 57 0 0 48 0 91 0 0 0 48
0

```